**Alien Enzyme Invasion!**

**\*UGRENT MESSAGE FROM M.I.G. HEADQUARTERS\***

Deputy M.I.G. agents,

We are on the verge of a hostile alien invasion. Reports are coming in that beings from planet ZX-246 have already begun pre invasion placements around the globe. If we do not act quickly, the human race is in for a very dark time and possibly facing extinction. Since our main field agents are currently in red alert, I am hereby deputizing you as a deputy M.I.G. agent. I have sent you a sample containing an important enzyme utilized by the beings. If you can find a way to stop it from working, we can stop this invasion before it’s too late! I wish you the best of luck.

-Agent X

Director of M.I.G.

As you can see, this is a dire time for mankind. Using the samples provided to us by M.I.G. agents, you will be observing the behavior of the enzyme and decide on a way to neutralize it. Safety goggles will be required while you are participating in this M.I.G. sanctioned experiment.

Before you begin, make sure you and your partner(s) have the following:

* Test tubes containing enzyme sample
* Test tube rack
* Test tube tongs
* Marker
* 10ml graduate cylinder

Mark your test tubes 1-6 and then proceed onto part 1

**Part 1:**

We first need to understand how this enzyme regularly behaves.

1. Add 1 or 2ml of hydrogen peroxide to test tube number 1.

2. Record your observations on the data table.

3. After your initial observation, add another 1 or 2ml of hydrogen peroxide. Did a reaction still occur?

4. After recording your observations, move on to part 2

**Part 2:**

We need to test the effects of temperature on the enzyme. Perhaps high levels of heat or cold will be effective against the aliens.

When the enzyme is exposed to a hot environment, there will be an **increase/decrease** in enzyme activity because\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. Take test tube number 2 and place it in an ice bath. Record the temperature of the ice bath.

4. Take test tube number 3 and place it in a hot water bath. Record the temperature.

5. Allow test tubes 2 and 3 to acclimate in their environment for approximately 15-20 minutes before adding 1 to 2ml of hydrogen peroxide to each tube and record the results.

6. While you are waiting for the tubes to acclimate, move on to part 3!

**Part 3:**

Perhaps these alien enzymes have a preference for basic or acidic environments; this part is to test how the enzyme behaves within different pH environments.

When the enzyme is added to an acidic environment, there will be an **increase/decrease** in activity because\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

7. Add 5ml of pH 4 buffer to tube 4 and gently mix it with the enzyme fluid.

8. Add 5ml of pH 7 buffer to tube 5 and gently mix.

9. Add 5ml of pH 10 buffer to tube 6 and gently mix.

10. Let each tube sit for approximately 5 minutes, then add 3ml of hydrogen peroxide to each tube and record your observations. If you have not done so already, finish part 2 before moving on to the post lab questions.

|  |  |
| --- | --- |
| Test Tube Number | Observations |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |
| 6 |  |

Now that you have completed your experiments, we need your input!

**\*Defeating the alien invaders!\***

Based on your observations, what seems to work best in stopping the alien enzyme from functioning? How should we defeat the alien invasion?

GREAT JOB! You stopped the alien invasion and are the talk at M.I.G. headquarters! Who knows, perhaps you’ll be a permanent agent for us in the near future.

**Post Lab Questions:**

Answer these questions prior to turning in your lab.

1. In part 1 of the lab, when you added additional hydrogen peroxide, why did a reaction still occur?

2. Are enzymes or substrates used up in a reaction?

3. What happened to the enzyme when it was placed in the hot water bath? What may have caused a change in its reactivity?

4. Did the enzyme behave differently based on the pH level of its environment?

5. Given an enclosed environment with a specific number of enzymes and a specific amount of substrate, what would happen to the level of enzymatic activity if you added more enzymes to the environment? What would happen to the amount of activity if you changed the amount of substrate?

6. Enzymes contain a specific area in which a specific substrate or substrates can bind to. What is the name of this area?

7. What does it mean when a protein becomes denatured? How might this affect the reaction rate if an enzyme became denatured?